

08812865



03/06/97

PATENT



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
 Box Application  
 Assistant Commissioner for Patents  
 Washington, D.C. 20231

**NEW APPLICATION TRANSMITTAL**  
**(35 U.S.C. § 111 AND 37 CFR § 1.53)**

Transmitted herewith for filing is the patent application of

Inventor(s): John B. Taylor

For (title): **PLANT FERTILIZER COMPOSITIONS CONTAINING PHOSPHONATE  
 AND PHOSPHATE SALTS, AND DERIVATIVES THEREOF**

**1. Type of Application**

This new application is for a Continuation-in-part (CIP)

**2. Benefit of Prior U.S. Application(s)(35 USC 120)**

- ☒ The new application being transmitted claims the benefit of prior U.S. application(s) and enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED

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**CERTIFICATE UNDER 37 CFR 1.8(a) and 1.10**

I hereby certify that, on the date shown below, this correspondence is being

- ☒ deposited with the United States Postal Services in an envelope addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231 with sufficient postage:

**MAILING**

37 CFR 1.8(a)

37 CFR 1.10

☐ as first class mail

☒ as "Express Mail Post Office to Addressee"  
 Mailing Label No. EM574500489US

**FACSIMILE TRANSMISSION**

☐ transmitted by facsimile to the Patent and Trademark Office

Date: March 4, 1997  
 428843.1  
 March 6, 1997

Chalynda M. Ragan  
 Chalynda M. Ragan

08812865 "030697"

**3. Papers Enclosed Which Are Required For Filing Date Under 37 CFR 1.53(b)(Regular) or 37 CFR 1.153 (Design) Application**

<u>18</u>	Pages of specification
<u>3</u>	Pages of claims (Nos. 1-13)
<u>1</u>	Pages of Abstract
<u>    </u>	Declaration
<u>    </u>	Sheets of drawing (Figs. 1-__)
	<input type="checkbox"/> formal
	<input type="checkbox"/> informal
	<input type="checkbox"/> identifying information has been placed on back of each sheet of drawings.

**4. Additional papers enclosed**

- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 CFR 1.98)
- ☐ Form PTO-1449
- ☐ Other

**5. Declaration or oath**

- ☐ Enclosed executed by inventor(s).
- ☒ Not Enclosed.

**6. Inventorship Statement**

The inventorship for all the claims in this application are:

- ☒ The same

or

- ☐ Are not the same. An explanation, including the ownership of the various claims at the time the **last** claimed invention was made,
  - ☐ is submitted.
  - ☐ will be submitted.

7. **Assignment**

- ☐ An assignment of the invention to \_\_\_\_\_:
- ☐ is attached. A separate \_ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or \_ FORM PTO 1906 is also attached.
- ☒ will follow.

8. **Fee Calculation (37 CFR 1.16)**

- A. ☒ Regular Application

**CLAIMS AS FILED**

Number filed	Number Extra	Rate	Basic Fee 37 CFR 1.16(a) \$770.00
Total Claims (37 CFR 1.16(c)) 13 -20=		X \$22.00	\$ 0.00
Independent Claims (37 CFR 1.16(b)) 4 -3=	1	X \$80.00	\$ 80.00
Multiple dependent claim(s), if any (37 CFR 1.16(d))		X \$260.00	\$ 0.00

- ☐ Amendment canceling extra claims enclosed.
- ☐ Amendment deleting multiple-dependencies enclosed.
- ☐ Fee for extra claims is not being paid at this time.

Filing Fee Calculation

\$850.00

9. **Small Entity Statement(s)**

- ☒ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is(are) attached.

Filing Fee Calculation (50% of A, B, or C above)

\$425.00

**10. Fee Payment Being Made At This Time**

- ☐ Not Enclosed
- ☐ No filing fee is to be paid at this time.
- ☒ Enclosed
- ☒ basic filing fee \$425.00
- ☐ recording assignment \$ 0.00  
(\$40.00;37 CFR 1.21(h))
- Total fees enclosed** **\$425.00**

**11. Method of Payment of Fees**

- ☒ Check in the amount of \$425.00
  - ☐ Charge Account No. \_\_\_\_ - \_\_\_\_ in the amount of \$ \_\_\_\_.
- A duplicate of this transmittal is attached.

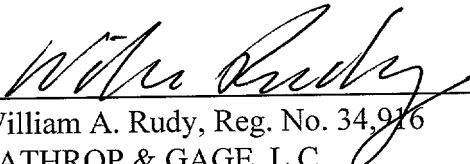
**12. Authorization to Charge Additional Fees**

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper to Account No. 12-0600:
  - ☒ 37 CFR 1.16(a),(f) or (g)(filing fees)
  - ☒ 37 CFR 1.16(b),(c) and (d)(presentation of extra claims)

**13. Instructions As To Overpayment**

- ☐ credit Account No. 12-0600
- ☒ refund

Respectfully submitted,

  
\_\_\_\_\_  
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ATTORNEY OF RECORD

14. **Incorporation by reference of added pages**

- ☒ Plus Added Pages For New Application Transmittal Where Benefit Of Prior U.S. Application(s) Claimed

Number of pages added 2

- ☐ Plus Added Pages For Papers Referred To In Item 4 Above

Number of pages added \_\_\_\_\_

- ☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added \_\_\_\_\_

**ADDED PAGES FOR APPLICATION TRANSMITTAL WHERE BENEFIT OF  
PRIOR U.S. APPLICATION(S) CLAIMED**

15. **Relate Back -- 35 U.S.C. 120**

- ☒ Amend the Specification by inserting before the first line the sentence:

"This is a continuation-in-part of co-pending application Serial Number 08/705,594  
filed on August 30, 1996."

or

International Application \_\_\_\_\_ filed on \_\_\_\_\_ and which  
designated the U.S."

16. **Relate Back -- 35 U.S.C. 119 Priority Claim for Prior Application**

The prior U.S. application(s), including any prior International Application  
designating the U.S., identified above in item 17, in turn itself claim(s) foreign  
priority(ies) as follows:

country	appl. no.	filed on
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The certified copy(ies) has (have)

- ☐ been filed on \_\_\_\_\_ in prior application  
0 / \_\_\_\_\_ which was filed on \_\_\_\_\_
- ☐ is (are) attached

**17. Maintenance of Copendency of Prior Application**

- A. ☐ Extension of time in prior application
- ☐ A petition, fee and response extends the term in the pending **prior** application until \_\_\_\_\_
- ☐ A **copy** of the petition filed in prior application is attached
- B. ☐ Conditional Petition for Extension of Time in Prior Application
- ☐ A conditional petition for extension of time is being filed in the pending **prior** application.
- ☐ A **copy** of the conditional petition filed in the prior application is attached

**18. Further Inventorship Statement Where Benefit of Prior Application(s) Claimed**

- (a) ☐ This application discloses and claims only subject matter disclosed in the prior application whose particulars are set out above and the inventor(s) in this application are
- ☐ the same
- ☐ less than those named in the prior application and it is requested that the following inventor(s) identified for the prior application be deleted:
- (b) ☒ This application discloses and claims additional disclosure by amendment and a new declaration or oath is being filed. With respect to the prior application the inventor(s) in this application are
- ☒ the same
- ☐ the following additional inventor(s) have been added:
- (c) ☐ The inventorship for all the claims in this application are
- ☒ the same
- ☐ not the same, and an explanation, including the ownership of the various claims at the time the last claimed invention was made
- ☐ is submitted
- ☐ will be submitted

**19. Abandonment of Prior Application (if applicable)**

- ☐ Please abandon the prior application at a time while the prior application is pending or when the petition for extension of time or to revive in that application is granted and when this application is granted a filing date so as to make this application co-pending with said prior application.

**20. Petition for Suspension of Prosecution for the Time Necessary to File an Amendment**

- ☐ There is provided herewith a Petition To Suspend Prosecution for the Time Necessary to File An Amendment (New Application Filed Concurrently)
- ☒ This transmittal ends with this page.



Mar. 4, 1997 3:25PM

DIAMOND R FERT  
LATHROP & GAGE L. C.

9847385944

No. 3695 F. 81

Applicant or Patentee: John Taylor  
Serial No. or Patent No: \_\_\_\_\_  
Filed or Issued: \_\_\_\_\_  
For: FERTILIZER COMPOSITIONS FOR PLANTS CONTAINING PHOSPHONATE AND PHOSPHATE SALTS AND DERIVATIVES THEREOF

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY  
STATUS (37 CFR 1.9(f) AND 1.27(c)) - SMALL BUSINESS CONCERN**

I hereby declare that I am

- ☐ the owner of the small business concern identified below:  
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN FOLIAR NUTRIENTS INC  
ADDRESS OF CONCERN 1420 Lemon St. Deland, FL 32120

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 18 CFR 121.8-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled FERTILIZER COMPOSITIONS FOR PLANTS CONTAINING PHOSPHONATE AND PHOSPHATE SALTS, AND DERIVATIVES THEREOF, by inventor(s) John Taylor, described in

- ☒ the specification filed herewith.  
☐ application Serial No. \_\_\_\_\_ filed \_\_\_\_\_  
☐ Patent No. \_\_\_\_\_ issued \_\_\_\_\_

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights in the invention is listed below\* and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(e) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

\*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27).

FULL NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of payment, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).



Mar. 4. 1997 3:25PM

DIAMOND R FERT  
LATHROP & GAGE L. C.

9847385944

NO. 3090 r. P. 82

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME AND TITLE OF PERSON SIGNING

ADDRESS OF PERSON SIGNING

SIGNATURE

DATE

JOHN B. TAYLOR, Vice President

1470 GUM ST. DE Land, FL 32720

John B. Taylor

3/4/97

RECEIVED 5/22/97

Received Time

Mar. 4. 3:42PM

425/201A



Inventor: John Taylor

Title: Plant Fertilizer Compositions Containing  
Phosphonate and Phosphate Salts, and Derivatives Thereof

Cross-Reference to Related Application

The present invention is a continuation-in-part of co-pending Serial Number 08/705,594 filed on August 30, 1996.

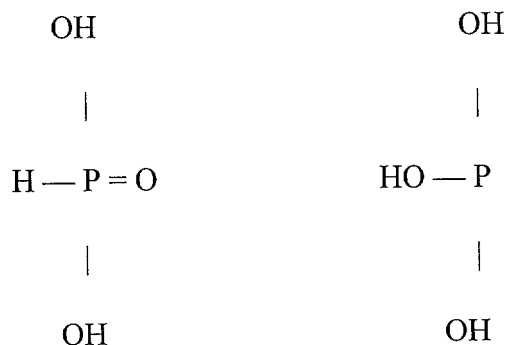
Background of the Invention

The present invention is broadly concerned with fungicidal compositions, and methods of use, which provide improved efficacy in controlling parasitic fungi in plants. More particularly, the compositions and methods of use of the invention include fungicidally effective amounts of both phosphate, preferably in the form of either mono, di, tri or dipotassium phosphate ( $\text{KH}_2\text{PO}_4$ ,  $\text{K}_2\text{HPO}_4$ ) and phosphonate, preferably in the form of either mono or dipotassium phosphonate ( $\text{KH}_2\text{PO}_3$ ,  $\text{K}_2\text{HPO}_3$ ), in aqueous solution.

According to another aspect of the present invention, the compositions and methods of use of the invention include growth response effective amounts of both phosphate, preferably in the form of either mono or dipotassium phosphate ( $\text{KH}_2\text{PO}_4$ ,  $\text{K}_2\text{HPO}_4$ ) and phosphonate, preferably in the form of either mono or dipotassium phosphonate ( $\text{KH}_2\text{PO}_3$ ,  $\text{K}_2\text{HPO}_3$ ), in aqueous solution.

Phosphorus is an essential major element in plant nutrition because it governs the energy producing reactions, including those that are oxidative, and photophosphorylative and the production of adenosine diphosphate (ADP) and adenosine triphosphate (ATP). Energy-rich phosphate bonds of ADP and ATP provide the energy for many of the physiological reactions that occur in plants.

The element phosphorous appears in two general forms that concern the present invention — phosphonate and phosphate. The term “phosphonate,” sometimes also referred to as “phosphite,” means the salts (organic or inorganic) of either phosphonic acid or phosphorous acid. Phosphonic and phosphorous acids have the formula  $\text{H}_3\text{PO}_3$  and a molecular weight of 82.00. Their structures from the International Union of Pure and Applied Chemistry are shown below:



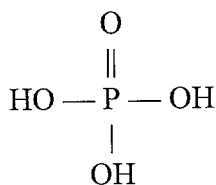
Phosphonic Acid

CA: 13598-36-2

Phosphorous Acid

CA: 10294-56-1

The term “phosphate” means the salts (organic or inorganic) of phosphoric acid having the formula  $\text{H}_3\text{PO}_4$ , molecular weight of 98, and has the following structure:



Phosphoric Acid

CA: 7664-38-2

5 In the past, various phosphonate compounds have been proposed as useful in fungicidal and fertilizer compositions for application to plants. See, e.g., U.S. Patent Nos. 4,075,324 and 4,119,724 to Thizy, describing phosphorous acid, its inorganic and organic salts, as a plant fungicide; U.S. Patent No. 4,139,616 to Dueret, describing fungicidal compositions based on phosphorous acid esters and salts thereof; U.S. Patent No. 4,542,023 to Lacroix et al., describing organophosphorus derivatives as possessing systemic and contact fungistatic and fungicidal activity; U.S. Patent Nos. 4,698,334 and 4,806,445 and 5,169,646 to Horriere et al., describing fungicidal compositions based on alkyl phosphonates; U.S. Patent Nos. 4,935,410 and 5,070,083 to Barlet, describing fungicidal aluminum tris-alkyl-phosphonate compositions; and U.S. Patent No. 5,514,200 to Lovatt, describing formulations of phosphorous-containing acid fertilizer for plants. (The teachings of the proceeding U.S. Patents are hereby incorporated by reference.) The above references disclose phosphonate compositions have been found to be effective for protecting plants, and particularly grape vines, citrus and fruit trees and tropical plants, against fungal attack.

15 Once assimilated, phosphonates have been shown to enhance the phytoimmune system. The phosphonate induced stimulation of the phytoimmune system is triggered by the induction of ethylene production, followed by a rapid accumulation of phytoalexins at the site of infection. Phosphonates have also been shown to have detrimental effect on the growth of Phycomycetes. See, Pegg, K.G. and deBoer, R.F., "Proceedings of the Phosphonic (Phosphorous) Acid Work Shop, *"Australasian Plant Pathology*, Vol. 19 (4) 1990.

20 In accordance with this development of the present invention, however, it has recently been discovered that phosphonates exacerbate the non-target Ascomycete fungi, and

other fungi producing an eiphytotic outbreak of much greater magnitude than the infections occurring without phosphonate treatment. This phenomenon is known as pathological acerbation.

5 In the past, phosphates were not viewed as a solution to pathological acerbation of Ascomycete fungal infections. This is because phosphates are viewed primarily as a fertilizer with only limited, or even detrimental, fungical properties. For example, U.S. Patent 5,514,200 teaches that phosphate fertilizers inhibit beneficial symbiosis between plant roots and mycorrhizal fungi, and further promote bacterial and fungical growth in the rhizosphere, including the growth of pathogenic fungi and other small soil-borne organisms. (Col. 2, lines 18-28). Phosphates have also been considered to be a competitive inhibitor for phosphonate assimilation, thus inhibiting the ability of phosphonates to protect against fungus attack. See, Pegg, K.G. and deBoer, R.F., "Proceedings of the Phosphonic (Phosphorous) Acid Work Shop, *Australiasian Plant Pathology*, Vol. 19 (4), pp. 117 and 144, 1990. Yet further, phosphonates and phosphates were believed to be "biological strangers," with the presence of phosphonates or its esters, exerting little or no influence on enzyme reactions involving phosphates. Robertson, H.E. and Boyer, P.D., "The Biological Inactivity of Glucose 6 — phosphonate, Inorganic Phosphites and Other Phosphites," *Archives of Biochemistry and Biophysics*, 62 pp. 380-395 (1956).

20 Accordingly, the requirements for a successful phosphonate-based fungicide depend on the elimination of the phosphonate-induced pathological ascerbation of Ascomycete fungical infections.

Moreover, the prior art teaching that phosphates and phosphonates are "biological strangers" is relevant to the lack of teaching of use of a composition of both for any agricultural use.

#### Summary of the Invention

5           The present invention addresses the problems outlined above, and provides an improved anti-fungicidal composition for plants that contains, as active ingredients, fungicidally effective amounts of both phosphonates and phosphates. According to the present invention, it has been discovered that the application to a plant of the inventive phosphonate/phosphate composition substantially eliminates pathological acerbation of Ascomycete fungi, while at the same time, provides a means to control Phycomycetes and Ascomycetes and other fungi with a single product.

          Thus, an object of present invention is to provide a fungicidal composition for protection for plants against fungal infection, especially Phycomycetes and Ascomycetes.

          Another object of the invention is to provide such anti-fungal protection with a single product that upon application does not cause pathological acerbation of Ascomycetes infections.

          A further object of the invention is to provide a method of treating plants and to provide anti-fungal protection in plants against attack by Phycomycetes, Ascomycete and other fungi and bacteria.

20           A yet further object of the invention is to provide an anti-fungal composition for treating plants that is environmentally safe, inexpensive to use and has low mammalian toxicity.

These and other objects of the invention are attained by the invention disclosed below. According to the invention, anti-fungicidal compositions for the protection of plants, especially citrus and fruit trees and vines against fungus attack, preferably contain as an active material a fungicidally effective amount of at least a first salt formula selected from the group consisting of  $\text{KH}_2\text{PO}_3$ ,  $\text{K}_2\text{HPO}_3$ , and  $\text{K}_3\text{PO}_3$ , and at least a second salt selected from the group consisting of  $\text{KH}_2\text{PO}_4$ ,  $\text{K}_2\text{HPO}_4$  and  $\text{K}_3\text{PO}_4$ , in a mixture with an agriculturally acceptable carrier.

The composition preferably comprises an aqueous solution wherein each salt is present in solution from about 20 millimole to about 5% vol./vol..

According to another aspect of the invention, the amount of the first salt is one part by weight and the amount of the second salt is between 0.001 and 1,000 parts by weight.

Phosphonate salts useful in the practice of the invention also include those organic and inorganic salts taught by U.S. Patent Nos. 4,075,324 and 4,119,724 to Thizy et al., (see, e.g., col. 1, ln. 51-69 through col. 2, ln. 1-4).

The present invention, in another aspect, also has been found to be effective as a growth stimulator or fertilizer for plants, and addresses the problems in the art with regard to finding effective fertilizers. Thus, the present invention provides a means for applying a single product to plants which is both an effective fungicide and an effective fertilizer.

It is therefore an object of this aspect of the invention to present a composition and method of use which functions as a fertilizer for plants.

A further object of this aspect of the invention is to function as a fertilizer which provides substantial growth response results.

Another object of this aspect of the invention is to function as a fertilizer which is ecologically and human compatible, is economical, and is efficient.

These and other objects, features and advantages of the invention will become more apparent with reference to the accompanying specification and claims.

#### A Detailed Description of the Preferred Embodiments.

The following examples set for preferred concentrations and techniques for formulation thereof, as well as methods of application and use and test results demonstrating the efficacy of the inventive concentration in protecting plants against attack by Ascomycete and Phycomycete fungi. It is to be understood, however, that these Examples are presented by way of illustration only and nothing therein shall be taken as a limitation upon the overall scope of the invention. The specific components tested in the Examples were prepared and applied as follows.

#### Method of Preparation

A. Potassium Phosphonate ( $\text{KH}_2\text{PO}_3$ ) Aqueous Solution.  $\text{H}_3\text{PO}_3$  is produced by the hydrolysis of phosphorus trichloride according to the reaction:  $\text{PCl}_3 + 3\text{H}_2\text{O} > \text{H}_3\text{PO}_3 + 3\text{HCl}$ . The HCl is removed by stripping under reduced pressure and the phosphonic acid ( $\text{H}_3\text{PO}_3$ ) is sold as a 70% acid solution.

The phosphonic acid is then neutralized in aqueous solution by potassium hydroxide according to the reaction:  $\text{H}_3\text{PO}_3 + \text{KOH} > \text{KH}_2\text{PO}_3 + \text{H}_2\text{O}$  to about pH 6.5 and to produce a 0-22-20 liquid weighing 11.15 lbs./gal. This solution is commercially available and is sold under the trademark "Phos-Might" by Foliar Nutrients, Inc., Cairo, GA 31728.



B. Potassium Phosphate ( $K_2HPO_4$ ) Aqueous Solution. Mono potassium phosphate (0-51.5-34) is reacted with 45% potassium hydroxide in aqueous solution to produce dipotassium phosphate by the following reaction: This solution is commercially available and is sold under trademark "K-Phos" by Foliar Nutrients, Inc., Cairo, GA 31724

5  $KH_2PO_4 + KOH \rightarrow K_2HPO_4 + H_2O$  with a product density of 1.394 at 20 C and a solution pH of 7.6 producing a 0-18-20 analysis.

C.  $KH_2PO_3/K_2HPO_4$  Solution. Varying amounts of each compound ( $K_2HPO_3$ ;  $KH_2PO_3$ ;  $K_2HPO_4$ ; or  $KH_2PO_4$ ) in aqueous solution are combined at rates ranging from 20 millimole to 5% vol./vol., depending on crop host and the pathogen complex and level of infection.

#### Method of Application

The preferable method of application is foliar, either by ground or aerial equipment, but is not limited to that method alone. Injection or soil applications, for example, could also be efficacious depending on specific crops and pathogens.

The inventive compositions have utility on fruit crops, agronomic crops, ornamentals, trees, grasses, vegetables, grains, and floricultural crops, as well as, some aquatic crops including water cress.

The fungicidal properties of the compounds according to the invention are various, but are particularly interesting in the case described in the following examples:

20 Examples 1-5 exemplify a portion of these applications. In Examples 1-4, fungicidal treatments were applied to ornamentals, citrus and vegetables. In each of Examples 1-4,

5 treatments were applied as a one gallon solution by a back pack sprayer, maintained at about 60 psi, in sufficient quantities of water to achieve thorough coverage.

All treatments were applied to the appropriate number of experimental units assigned in a randomized complete block (RCB) design replicated four times. Example #5 was a pre-harvest fungicidal spray evaluation on "Nova" tangelos.

As used in the examples, "percent infection" means percent of leaves that exhibit fungus lesions. "Phytotoxicity" means number crop injury to leaves that fell off the plant following the application of the solution.

The Ascomycete fungi were the subjects of testing in Examples 1 through 5 and are all members of the Ascomycete family.

#### EXAMPLE NO. 1

Dogwood\Powdery Mildew Fungicide Trial  
Trail Ridge Nursery, Keystone Hts., Florida

The compounds according to the invention are studied for the effect on the powdery mildew (*Oidium Spp.*), which is responsible for foliar infections in dogwood.

Potassium phosphonate and potassium phosphate solutions were applied in compositions as set forth in Table 1 below. An average of 5 six-inch pots per experimental unit with 4 repetitions in a randomized complete block ("RCB") design were considered. The solutions were applied to Dogwood (*Cornis Florida Var. "Weaver"*). The application of the compositions were made in April 25, 1996, May 8, 1996, and May 23, 1996. The effects of the various compositions were rated on May 30, 1996.

Table 1 shows that when a potassium phosphonate solution (containing no appreciable amount of phosphate) is applied to dogwood, pathological acerbation of the Ascomycete fungus occurs in 100 percent of the dogwood leaves, in contrast to the control, which exhibited only 30 percent infection. The inventive composition that combine potassium phosphate and potassium phosphonate showed a complete elimination of the pathological acerbation phenomenon, and in fact, dropped the amount of infection by about 20 percent.

TABLE 1

<u>TREATMENT</u>	<u>RATE/100 gal.</u>	<u>*%INFECTION</u>	<u>PHYTOTOXICITY</u>
1) POTASSIUM PHOS- PHONATE SOLUTION	1%	100	0
2) POTASSIUM PHOS- PHATE SOLUTION	1%	0	0
3) POTASSIUM PHOS- PHONATE SOLUTION	1%	10	0
+ POTASSIUM PHOS- PHATE SOLUTION	+ 1%		0
4) POTASSIUM PHOS- PHATE SOLUTION	2%	0	0
5) CONTROL	-	30	0

## EXAMPLE NO. 2

### Shumard Oak/Powdery Mildew Fungicide Trial Trail Ridge Nursery, Keystone Hts., Florida

5 In Example No. 2, the inventive compositions were tested for effectiveness against the powdery mildew (*Phyllactinia corylea*) that infects shumard oak (*Quercus shumardii*). In Example No. 2, an average of ten 3-gallon plots per experimental unit with 4 repetitions in a randomized complete block design were examined.

When only potassium phosphonate solution was applied, the percentage of infection increased to 40 percent, compared to a 20 percent infection in the control, indicating a pathological acerbation of the Ascomycete fungi. When the inventive composition including potassium phosphonate and potassium phosphate was applied, the infection was completely eliminated.

TABLE 2

<u>TREATMENT</u>	<u>RATE/100 gal.</u>	<u>*%INFECTION</u>	<u>PHYTOTOXICITY</u>
1) POTASSIUM PHOS- PHONATE SOLUTION	1%	40	0
2) POTASSIUM PHOS- PHATE SOLUTION	1%	0	0
3) POTASSIUM PHOS- PHONATE SOLUTION + POTASSIUM PHOS- PHATE SOLUTION	+ 1%	0	0
4) POTASSIUM PHOS- PHATE SOLUTION	2%	0	0
5) CONTROL	-	20	0

### EXAMPLE NO. 3

Citrus Alternaria Fungicide Trial  
Kerr Center, Vero Beach, Florida

In Example No. 3, the inventive composition was tested for effectiveness in citrus trees (*Alternaria citri*) that were infected with the fungi.

As used in Table No. 3 below, "% Y.L.D." means percent young leaf drop, and "% Y.F.D." means percent young fruit drop. %Y.L.D. and %Y.F.D. were determined by examining 4 terminals/tree with 4 repetitions in a randomized complete block design. The date on which the compositions were applied were March 21, 1996. The compositions were rated on April 2, 1996. When only potassium phosphonate solutions were applied, %Y.L.D. and %Y.F.D. increased from 6.2 and 1.5 to 23.9 and 37.9, respectively, indicating pathological acerbatation of the Ascomycete fungi. Application of the inventive composition not only eliminated the acerbatation, but showed an improvement in Y.L.D. and Y.F.D.

TABLE 3

<u>TREATMENT</u>	<u>RATE/100 gal.</u>	<u>%Y.L.D.</u>	<u>%Y.F.D.</u>	<u>PHYTOTOXICITY</u>
1) POTASSIUM PHOSPHATE SOLUTION	0.5%	5.2	3.8	0
2) POTASSIUM PHOSPHATE SOLUTION	1 %	2.5	2.5	0
3) POTASSIUM PHOSPHATE SOLUTION	2 %	1.5	1.0	0
4) POTASSIUM PHOSPHONATE SOLUTION	1 %	23.9	37.5	0

5) POTASSIUM PHOS- PHATE SOLUTION	0.5%	2.2	3.7	0
+ POTASSIUM PHOS- PHONATE SOLUTION	+ 0.5%			
6) CONTROL	-	6.2	1.5	0

#### EXAMPLE NO. 4

##### Carrot/Alternaria Fungicide Trial

In Example No. 4, carrot plots were inoculated with *Alternaria dauci* fungi. The plot sizes were single rows X 25 feet X 4 repetitions in a RCB design. The dates that compositions were applied were February 2, 9, 15, 22, and March 8, 14, 22, and 28, 1996. The fungi infections were rated on April 5 and April 23, 1996. The second rating was 25 days after the last fungicide application. The test took place at Sanford, Florida.

Application of the inventive solutions including potassium phosphonate and potassium phosphate improved the extent of infection from that otherwise occurring in the control carrots. Although the solution making use of only potassium phosphonate caused a slight improvement from the infection occurring in the control, it was substantially less than that associated with the inventive composition.

Also shown in Example No. 4 is a comparison of the effectiveness of the inventive composition to other fungicides, including Cu-Alexin and Fe-Alexin. This test demonstrates that the inventive composition is as effective as other well known fungicides, but without being as environmentally toxic.

TABLE 4

TREATMENT	RATE/100 GAL.	AVG% INFECTION	
		4/5/96	4/23/96
1) POTASSIUM PHOSPHATE SOLUTION	1%	6.9	8.2
2) POTASSIUM PHOSPHONATE SOLUTION	1%	18.7	28.8
3) POTASSIUM PHOSPHATE SOLUTION	0.5%	8.9	10.7
+ POTASSIUM PHOSPHONATE SOLUTION	+ 0.5%		
4) Cu-ALEXIN	0.2 lb ai	8.8	11.6
5) Fe-ALEXIN	0.2 lb ai	12.7	12.9
6) CONTROL	-	23.0	34.8

## EXAMPLE NO. 5

Citrus Preharvest Spray Trials  
Kerr Center, Vero Beach, Florida

In Example No. 5, twenty-two fruits, each from five nova tangelo trees, were randomly selected and marked. The fruits were scuffed with an emery board and then sprayed with the compositions set forth below in Table 5, with five treatments on the same day. Seven days later, the fruit was picked and stored for two weeks in sealed white plastic bags, then examined for penicillium mold.

The degree of infection was rated using following scores: 0 = no infection, 1 = light infection (less than 30% coverage), 2 = severe infection (100% coverage). The degree of infection is the mean of scores from 22 fruit.

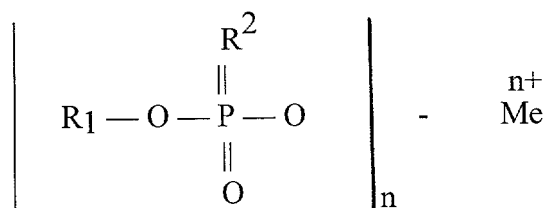
TABLE 5

<u>TREATMENT</u>	<u>RATE</u>	<u>DEGREE OF INFECTION</u>	<u>#ROTTEN FRUIT</u>	<u>PHYTOTOXICITY</u>
1) POTASSIUM PHOSPHONATE SOLUTION	1%	1	9	0
2) POTASSIUM PHOSPHONATE SOLUTION	2%	0.91	12	0
3) POTASSIUM PHOSPHATE SOLUTION	1%	0	0	0
4) POTASSIUM PHOSPHATE SOLUTION + POTASSIUM PHOSPHONATE SOLUTION	0.5% + 0.5%	0.27	3	0
5) CONTROL	-	1.41	12	0

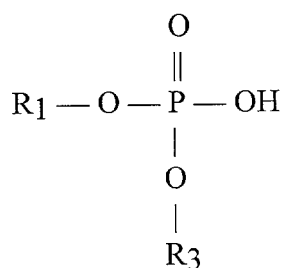
The above Examples demonstrate that the inventive compositions are useful in protecting plants against attack by Phycomycete , Ascomycete and other fungi and bacteria with the application of one solution.



It will also be appreciated that compositions for controlling Phycomycete and Ascomycete fungi diseases in plants may also contain phosphate and phosphonate compounds comprising a fungicidally effective amount of at least a first salt having the following formula:



And a second salt having the following formula:



Where R<sub>1</sub> is selected from group consisting of H, K, an alkyl radical containing from 1 to 4 carbon atoms, halogen-substituted alkyl or nitro-substituted alkyl radical, an alkenyl, halogen-substituted alkenyl, alkynyl, halogen-substituted alkynyl, alkoxy-substituted alkyl radical, ammonium substituted by alkyl and hydroxy alkyl radicals;

R<sub>2</sub> and R<sub>3</sub> are selected from a group consisting of H and K;

Me is selected from a group consisting of K, alkaline earth metal cations, aluminum atom; ammonium cation; and

n is a whole number from 1 to 3, equal to the valence of Me.

It will be appreciated that foliar applications of the inventive compositions will be effective as a common agricultural practice to control root pathogens caused by *Phytophthora*, *Phythium*, and foliar infections caused by *Plasmopara*.

It will also be appreciated that the inventive compositions will have biocidal and arthropod pest control activity, and also have fertilizer effects, in plants. (See e.g., U.S. Pat. Nos. 5,206,228, 5,133,891 and 5,514,200).

According to another aspect of the invention, compositions including both potassium phosphate and potassium phosphonate have been found to produce substantial growth response in certain plants. Table 6 below is illustrative:

TABLE 6  
FOLIAR NUTRITIONAL EVALUATIONS OF K-PHOS AND PHOS-MIGHT ON RHAPHIOLEPIS INDICA

TREATMENT	RATE	No. of Shoots/Rep.				AVG
		A	B	C	D	
1) POTASSIUM PHOSPHONATE SOLUTION	1%	22	13	20	15	17.5
2) POTASSIUM PHOSPHATE SOLUTION	1%	28	23	25	32	27.0
3) POTASSIUM PHOSPHONATE SOLUTION	1/2%	23	26	24	8	20.3
+ POTASSIUM PHOSPHATE SOLUTION	+					
	1/2%					

4) POTASSIUM PHOSPHATE SOLUTION	2%	24	38	32	24	29.5
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5	5) CONTROL-	--	4	1	7	3	3.8
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Experimental units = 3 x 3 gallon containers x 4 repetitions with treatments assigned in a randomized complete block design. Application dates for treatments A-D were approximately one, two, four, and three weeks apart respectively (October 31, 1996; November 7, 1996; November 20, 1996, December 19, 1996, and January 8, 1997 respectively; rated January 14, 1997).

As can be seen by Table 6, all four nutritional treatments provided growth responses greater than the untreated control, and K-PHOS at 1% and 2% were superior to PHOS-MIGHT at 1% and the combination of 1/2% each of PHOS-MIGHT + K-PHOS. The combination, however, produced substantially higher growth responses than the control, in fact, on a level similar to the individual treatments of K-PHOS or PHOS-MIGHT. The higher growth responses, compared to the control, can be expected when the inventive composition of Potassium Phosphate salt and Potassium phosphonate salt aqueous solution wherein each said salt is present in solution from about .25% vol./vol. to about 3.0% vol./vol., and preferably between .5% vol./vol. and 2.0% vol./vol. It is theorized that the unexpected growth responses are due to the slow conversion of  $PO_3$  in the inventive composition to  $PO_4$  after application. This composition further provides the added benefit of being fungicidal as well.

The disclosures in all references cited herein are incorporated by reference.

What is Claimed is:

1. A fertilizer composition for stimulating growth in plants comprising:  
a growth stimulating effective amount of at least a first salt selected from a group consisting of  $K_2HPO_3$ ,  $KH_2PO_3$  and  $K_3PO_3$ ; and a second salt selected from a group consisting of  $K_2HPO_4$ ,  $KH_2PO_4$  and  $K_3PO_4$ .

2. The composition according to claim 1 wherein said composition comprises an aqueous solution, wherein each said first and second salt being present in solution from about .25% vol./vol. to about 5% vol./vol.

3. The composition according to claim 1 wherein the amount of said first said salt is one part by weight and the amount of said second salt is between 0.001 and 1,000 parts by weight.

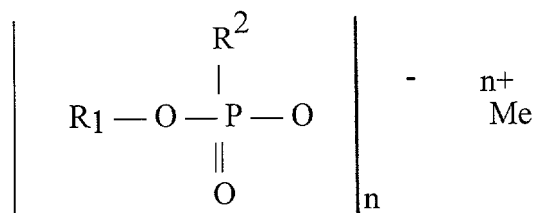
4. A method of stimulating growth in plants comprising:  
applying to the plants in growth stimulating effective amounts at least a first salt selected from a group consisting of  $K_2HPO_3$ ,  $KH_2PO_3$  and  $K_3PO_3$ ; and a second salt selected from a group consisting of  $K_2HPO_4$ ,  $KH_2PO_4$  and  $K_3PO_4$ .

5. The method according to claim 4 wherein said composition comprises an aqueous solution, wherein each said first and second salt being present in solution from about .25% vol./vol. to about 5% vol./vol.

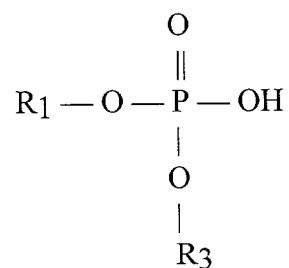
6. The method according to claim 4 wherein the amount of said first said salt is one part by weight and the amount of said second salt is between 0.001 and 1,000 parts by weight.

7. A composition for fertilizing comprising:

a growth stimulating effective amount of at least a first salt having the following formula:



and a second salt having the following formula:



where R<sub>1</sub> is selected from group consisting of H, K, an alkyl radical containing from 1 to 4 carbon atoms, halogen-substituted alkyl or nitro-substituted alkyl radical, an alkenyl, halogen-substituted alkenyl, alkynyl, halogen-substituted alkynyl, alkoxy-substituted alkyl radical, ammonium substituted by alkyl or hydroxy alkyl radicals;

R<sub>2</sub> and R<sub>3</sub> are selected from a group consisting of H and K;

Me is selected from a group consisting of K, alkaline earth metal cations, or aluminum atom; ammonium cation; and

n is a whole number from 1 to 3, equal to the valence of Me.

8. The composition according to claim 7 wherein said composition comprises an aqueous solution, wherein each said first and second salt being present in solution from about .25% vol./vol. to about 5% vol./vol.

9. The composition according to claim 7 wherein the amount of said first said salt is one part by weight and the amount of said second salt is between 0.001 and 1,000 parts by weight.

10. The composition according to claim 1 which is fungicidal.

11. A fungicidal/fertilizer composition comprising from about .25% vol./vol. to about 5% vol./vol. of a phosphite salt and a phosphate salt mixture.

12. A composition according to claim 10 wherein the phosphite salt and the phosphate salt each comprise about 1/2% by weight of the composition.

13. A composition according to claim 10 which is aqueous.

### ABSTRACT OF THE DISCLOSURE

A fertilizer composition for plants containing phosphonate and phosphate salts, and derivatives thereof is disclosed. The composition provides a single product which may be employed to stimulate the growth response in plants.